Roll No. ..... Total Pages : 3

BT-6/M-20 **36135**

ELECTRIC DRIVES AND TRACTION
Paper–EE-310 N

Time : Three Hours] [Maximum Marks : 75

Note : Attempt *five* questions in all, selecting at least *one* question from each unit. All questions carry equal marks indicated against them.

UNIT–I

1. (a) Explain the block diagram of an electric drive. State essential parts of electric drives. 7

(b) A constant speed drive has the following cycle :

(i) Load rising from 0 to 400 kW : 5 min.

(ii) Uniform load of 500 kW : 5 min.

(iii) Uniform load having regenerative power of 400 kW returned to supply : 4 min.

(iv) Remains idle for : 2 min.

Estimate power rating of the motor. Assume losses to be proportional to $(\text{power})^2$. 8

2. (a) Discuss the multi-quadrant operation of electric drive. 8

(b) A motor is used to drive a hoist. Motor characteristrics are given by :

Quadrants I, II and IV : T = 200–0.2 N, N–m

Quadrants II, III and IV : T = –200–0.2 N. N–m

Where N is speed in r.p.m.

When hoist is loaded, the net load torque

T_l = 100, N–m and when it is unloaded, net load torque T_l = –80, N–m. Obtain the equilibrium speeds of operation in all the four quadrants. 7

UNIT–II

3. (a) Discuss the regenerative method of braking of dc motors. 7

(b) A 220 V, 800 rpm, 8 A separately excited motor has an armature resistance of 0.12 Ω. Motor is driving under rated conditions, a load whose torque is same at all speeds. Calculate motor speed, if the source voltage drops to 200 V. 8

4. (a) How can the speed of dc driver be controlled ? Discuss any *one* speed control method in brief. 7

(b) Describe the operation of a single-phase fully-controlled rectifier control of dc separately excited dc motor ? 8

UNIT–III

5. (a) Explain the operation of a deep-bar squirrel-cage induction motor. 7

(b) Discuss the regenerative braking method of induction motor. What are its advantages ? 8

6. (a) What is the stator voltage control of induction motor? Explain. 7

(b) State and explain the roles of a damper winding in a synchronous motor. 8

UNIT–IV

7. (a) Discuss the speed-time curve of a traction drive. How is it approximated ? 7

(b) A 100-tonne motor coach is driven by 4 motors each developing a torque of 5000 N-m during the acceleration. If up-gradient is 50 in 1000, gear ratio $a = 0.25$, gear transmission efficiency 98%, wheel radius 0.54 m, train resistance 25 N/tonne, effective mass on account of rotational inertia is 10% higher, calculate the time taken to attain a speed of 100 kmph. 8

8. (a) Define the coefficient of adhesion ? What are the factors that influence its value ? 7

(b) A train service consists of following :

Uniform acceleration of 5 kmphps for 30 sec.

Free running for 10 min.

Uniform braking at 5 kmphps for stopping A stop of 5 min.

Calculate :

(i) Distance between the stations,

(ii) Average speed, and

(iii) Scheduled speed. 8